REMARKS

I. INTRODUCTION

The Office Action mailed on January 8, 2007 and the references cited therein have been carefully studied and, in view of the following remarks, reconsideration and allowance of this application are most respectfully requested. Claims 1-34 are currently pending in the present application, and claims 1-34 have been rejected. Reconsideration of the subject patent application in light of the present remarks is respectfully requested.

II. REJECTIONS UNDER 35 U.S.C. § 102

A. Rejections under 35 U.S.C. § 102(b)

Claims 1-3, 9-11, 17-19, 24-26, and 33-34 stand rejected under 35 U.S.C. § 102(b) as being anticipated by United States Patent No. 6,150,605 ("Han"). It is respectfully submitted that these rejections should be withdrawn for at least the following reasons.

To anticipate a claim, the reference must disclose each and every element of the claimed invention. *Verdergaal Bros. v. Union Oil Co. of Cal.*, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987). Applicants respectfully submit that Han does not disclose or suggest each and every element of these claims.

Specifically, Applicants submit that Han does not disclose or suggest a bulk heterojunction as claimed by Applicants. The Examiner believes that the interface in Han's device provides a bulk heterojunction "since it has some protrusions (as shown in, for example, Fig. 1)." *See* ¶ 2.a of Office Action mailed on January 8, 2007. Applicants respectfully submit that the Examiner has mischaracterized the device depicted in Fig. 1 of Han and appears to misunderstand "bulk heterojunction."

The device in Fig. 1 of Han is directed to a type of dye sensitized solar cells. The specification describes the theory of how the device of Fig. 1 works as follows:

> When sunlight is applied to the colorant in the solar cell, the colorant absorbs the light to be raised to an excited state. Electrons and holes generated by this excitation move to respective semiconductor films and then move via the transparent electrically conductive film to the counter electrode. On the other hand, the electrons remaining in the colorant inside the solar cell return to the colorant of the opposing side through the intermediary of the redox species in the electrolyte. Through such a process, electric currents are generated, whereby the light energy is continuously converted into electrical energy. Col. 5, line 66 – Col. 6, line 9.

This describes a particular type of solar cell, namely a dye sensitized solar cell, which is very different from Applicants' invention. Dye sensitized solar cells use sensitized dye or colorant in conjunction with semiconductor film to harvest sunlight. When a dye absorbs light, its electrons are excited and jump to the semiconductor film. It is then collected by the counter electrode and supplied to an external load. The dye molecule which is oxidized in the process, recovers its initial state by the transfer of electrons from the electrolyte in a redox reaction. *See e.g.* Gratzel, *Dye-Sensitized Solid-State Heterojunction Solar Cells*, MRS Bulletin, Vol. 30, Jan. 2005, for more detailed explanation of dye sensitized solar cells.

Applicants' invention is different from the device of Fig. 1 of Han in many respects. For example, none of the devices taught by Han disclose a bulk heterojunction and none are fabricated using organic vapor deposition. The Examiner points to para. [0044] of Han as teaching vapor deposition of organic semiconductor. ¶2.a of Office Action mailed on January 8, 2007. Applicants are unable to locate this teaching in Han (U.S. Patent 6,150,605) and note that this patent does not include paragraph numbers; only line numbers.

Applicants also disclose and claim a method for fabricating a device having a bulk heterojunction. Independent claims 1, 17, 33, and 34 each claim an optoelectronic device having a bulk heterojunction. Claims 2, 3, 9-11, 18, 19, and 24-26 ultimately depend from these independent claims and therefore include this element.

Han does not teach or suggest a bulk heterojunction. Although Fig. 1 of Han depicts the colorants or dyes in dark wavy lines, Applicants respectfully submit that this does not teach a bulk heterojunction as claimed by Applicants. Nowhere in Han is the term "bulk

heterojunction" mentioned. In fact, the device of Fig. 1 of Han cannot have a bulk heterojunction as understood by one skilled in the art. Fig. 1 of Han describes a device that uses inorganic semiconductor layers in the solar cells whereas the term "heterojunction" is more commonly used in organic materials to describe the interface between an appropriate donor and acceptor material or two other organic materials. Moreover, in the method claimed by Applicants, at least one layer is deposited using organic vapor phase deposition (OVPD). Han does not teach OVPD to deposit any layer. Further, the device depicted in Fig. 1 is not comprised of organic material and its layers are not deposited by OVPD.

The Examiner appears to believe that anything resembling a protrusion (including wavy lines) teaches a bulk heterojunction. Applicants respectfully submit that this interpretation ignores the plain meaning of the term "bulk heterojunction" as described in this application and understood by one skilled in the art. Although bulk heterojunctions may be characterized by protrusions having certain characteristics, a protrusion is not necessarily the same thing as nor does it teach a bulk heterojunction.

Bulk heterojunction devices, as understood by one skilled in the art, are characterized by an interpenetrating network of donor and acceptor materials, providing a large interface surface area where photoinduced charge transfer by excitons into separated electrons and holes can efficiently occur. The interface in a bulk heterojunction taught by Applicants may be characterized as being "highly folded" such that it has a relatively high surface area-to-volume ratio. The protrusions described by Applicants, i.e. the protrusions of the first organic layer, are the results of deliberate design to increase the surface area-to-volume ratio. *See* specification para. [0041]-[0042]. It is believed that "[b]y increasing this surface area-to-volume ratio, the exciton dissociation probability, and hence the efficiency, of the fabricated optoelectronic device are increased." *See* specification paras. [0029] and [0038].

Applicants believe that organic small-molecule bulk heterojunctions had not been successfully fabricated using OVPD prior to this invention. Polymer bulk

heterojunctions had previously been fabricated by spin coating (see specification paras. [0027] and [0029]) and small molecule bulk heterojunctions had been fabricated by co-deposition and annealing with physical confinement to create phase separation. However, as explained in paragraphs [0030]-[0031] of the present specification, bulk heterojunctions in organic small molecular systems had been largely unsuccessful.

Thus, for at least the preceding reasons, Applicants respectfully submit that Han does not anticipate claims 1-3, 9-11, 17-19, 24-26, and 33-34 in this application.

B. Rejections under 35 U.S.C. § 102(e)

Claims 1-5, 8-11, 17-19, 23-26, and 33-34 stand rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent Publication No. 2004-0121508 ("Foust"). It is respectfully submitted that these rejections should be withdrawn.

To anticipate a claim, the reference must disclose each and every element of the claimed invention. *Verdergaal Bros. v. Union Oil Co. of Cal.*, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987). Applicants respectfully submit that Foust does not disclose or suggest each and every element of these claims.

Foust is directed to large organic devices and methods of fabricating such devices. The devices and methods taught by Foust use a flexible and rigid plastic substrate. However, Foust does not teach or disclose a bulk heterojunction or an organic layer having a surface area to volume ratio of at least 5:1.

The Examiner appears to believe that Foust teaches the method claimed in Applicants' independent claims 1 and 17. Specifically, the Examiner stated that "[o]rganic compounds and other layers have some roughness wherein a first layer tends to adhere to itself, even at the atomic scale, ***inherently forming protrusions since Foust teaches the method as disclosed in the claims 1 and 17.***" *See* ¶ 3.a of Office Action mailed on January 8, 2007 (emphasis added). Applicants respectfully submit that Foust teaches no such method because Foust does not teach bulk heterojunctions as understood by one skilled in the art and

as defined in this application by Applicants. Applicants submit that, for the reasons stated above, these "protrusions" or "roughness" do not teach the bulk heterojunction disclosed and claimed by Applicants herein.

Claims 1, 2, 7, 9-13, 22, 25-28 and 33-34 stand rejected under 35 U.S.C. § 102(e) as being anticipated by United States Patent No. 6,995,445 ("Forrest I"). It is respectfully submitted that these rejections should be withdrawn.

The Forrest I patent teaches an organic photosensitive detector which may be fabricated using OVPD. However it doesn't teach or disclose the bulk heterojunction taught and claimed by Applicants. Independent claims 1, 17, 33, and 34 each claim an optoelectronic device or method having a bulk heterojunction. Claims 4-5, 8-11, 18, 19, and 23-26, ultimately depend from these independent claims and therefore include this element.

For the reasons already stated above, Applicants respectfully submit that Forrest I does not anticipate Applicants' claims. Moreover, the Examiner stated that "[t]he first electrode can be an anode, which tends to be very rough, and induce protrusions in the deposited first layer." ¶ 4.a of Office Action mailed on January 8, 2007. Applicants submit that, for the reasons stated above, these "protrusions" do not teach the bulk heterojunction disclosed and claimed by Applicants herein.

Applicants respectfully submit that the rejections under 35 U.S.C. § 102 have been overcome and should therefore be withdrawn.

III. REJECTIONS UNDER 35 U.S.C. § 103

Claims 4 and 5 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Han. It is respectfully submitted that these rejections should be withdrawn for at least the following reasons.

Applicants respectfully submit that the Examiner has misinterpreted Han as teaching a first layer having a surface area to volume ratio of at least 5:1. *See* ¶ 6 of Office Action mailed on January 8, 2007. The Examiner cites para. 0036 of Han as teaching a first

layer having a thickness of 0.01 microns. Applicants are unable to locate this teaching in Han (U.S. Patent 6,150,605) and note that this patent does not include paragraph numbers; only line numbers. Applicants respectfully suggest that the Examiner may have meant to cite to a different reference. Nevertheless, the Examiner appears to suggest that the surface area and volume of the first layer of Han (or the reference the Examiner meant to cite) may be calculated by assuming a uniform thickness of the organic layer ("surface area is all sidewalls plus both a bottom and upper surface of a layer." *See* ¶ 6 of Office Action mailed on January 8, 2007). Applicants respectfully point out that in [0038] of the specification, Applicants specifically state that the "surface area" does not refer to that of the entire deposited first layer but only to the surface area of the deposited first layer which will be in contact with the second layer (i.e. the interface of the first and second layers).

Claims 6 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Foust in view of United States Patent No. 6,337,102 ("Forrest II"). Claims 7, 12-16, 22, and 27-32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Foust in view of United States Patent Publication No. US 2003/0042846 ("Forrest III"). Claims 20 and 21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Foust in view of United States Patent Publication No. US 2002/0197462 ("Forrest IV").

As described above, neither Foust nor the Forrest II, III, or IV references teach or suggest a bulk heterojunction. Thus, Forest II, III, and IV do not cure the shortcomings of Foust or the Forrest I reference, as discussed above, namely that these references do not teach or suggest a bulk heterojunction. Applicants note that Forest IV teaches away from "using thin cells with multiple or highly folded interfaces" for "circumventing the diffusion length limitation." Forest IV, [0022]. Specifically, Forest IV notes that "none of these proposals has led to a significant improvement in overall performance of solar cells, particularly at high intensities." Forest IV, [0022]. Thus one skilled in the art would not read Forest IV as teaching, suggesting, or providing motivation or reason for the use of organic solar cells having bulk heterojunctions.

Thus, Applicants respectfully submit that the rejections under 35 U.S.C. § 103 have been overcome and should therefore be withdrawn.

IV. CONCLUSION

Applicants respectfully submit that the pending claims are now in condition for allowance and request that such action be taken. If for any reason the Examiner believes that prosecution of this application would be advanced by contact with the Applicants' attorney, the Examiner is invited to contact the undersigned at the telephone number given below.

Respectfully submitted,
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Dated: May 8, 2007 By: Melissa Alegre

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